

## **GSFC DEVELOPMENTS SINCE JULY 1997 TEAM MEETING**

### **Evaluated 100 level test data set -**

Done with JPL prototype - October 97 version

Small degradation in results is consistent with use of microwave product initial conditions

### **Status of upgrades to JPL prototype final product algorithm**

Included some suggested upgrades from last team meeting

- Second pass temperature retrieval step including select water vapor channels
- Updated noise covariance matrix
- Speeded up code by optimizing calculations

Not included

- Closed loop system, incorporation of microwave channels in  $T_s$  retrieval
- Higher order correction to cloud cleared channel noise covariance matrix

### **Improved approach to cloud clearing**

Uses 9 single spot fields of view rather than 3 three-spot fields of view

Determines number of cloud formations in a scene

Improves results for two cloud formation cases

Allows for better prediction of clear column radiance errors

Has been tested successfully using many cloud formations

### **Realization of need for angle correction within 3x3 array for cloud clearing**

Implications regarding full orbit test

## **EVALUATION OF NEW 100 LEVEL TEST DATA SET**

### **New 100 Level Data Set**

Cases analogous to old 66 level NA, NB, NC, DB, DC, DD, DP  
but unknown emissivity in N cases

Truth for mid-upper stratosphere utilizes UARS climatology

100 Level IR transmittances from Strow (1995 Delivery?)

more up to date spectroscopy

far wings in channel spectral response function

100 Level MW transmittances from Rosenkranz

should be minimal changes

### **Evaluation Used 3 Data Sets**

old 66 level test

new 100 level test

new 66 level test with truth analogous to new 100 level test

First product not available for new 100 level or new 66 level test

Microwave product available for all test data

### **Conducted preliminary comparisons for**

old 66 level first product guess vs. old 66 level microwave guess

old 66 level microwave guess vs. new 66 level microwave guess

new 66 level microwave guess vs. new 100 level microwave guess

## **PRELIMINARY FINDINGS OF 100 LEVEL DATA TEST**

### **Study so far is first order sanity check**

Was temporarily insane until a number of bugs were found and corrected

### **Results shown are hot off the presses**

### **Final product algorithm is identical to current 66 level prototype except for RTE**

Stratospheric functions do not take advantage of higher 100 level resolution

Effect of uncertainty in temperature on H<sub>2</sub>O transmittance not accounted for

## **EVEN SO**

### **Current 100 level prototype system performs reasonably well**

### **Results should improve somewhat with**

First product initial guess

Optimization for 100 levels, new physics, and new channels

Incorporation of further 66 level improvements in prototype

## ZENITH ANGLE CORRECTION FOR CLOUD CLEARING

All radiative transfer calculations done at observed zenith angle - no limb correction necessary

**However**

3x3 array of AIRS spots has 3 zenith angles

**Moreover**

$R_{i,CLR}$  is extrapolated from the 9 observations (made at different angles)

Therefore in a 3x3 block, 6 observations at the inside and outside angles should be corrected to the central angle

$$\mathbf{R}_{i,k}^{\pm} = \mathbf{R}_{i,k}^{\pm} + \delta \mathbf{R}_{i,k}^{\pm}$$

$\delta \mathbf{R}_{i,k}^{\pm}$  can be estimated using physics - **is computer intensive!!**

Needed for all channels to produce clear column radiance product

Order of magnitude increase in execution time

**This correction is necessary for both first product and final product cloud clearing steps if 3x3 array is used**

## RECOMMENDATION - CREDIT TO LARRY McMILLIN

Generate regression correction coefficients for each AMSU A angle  $k=1,15$

$$\delta \mathbf{R}_{i,k}^{\pm} = \mathbf{A}_{i,j,k}^{\pm} \mathbf{R}_{j,k}^{\pm}$$

where  $\mathbf{A}_{i,j,k}$  is generated from an ensemble of atmospheric, surface, cloud, and sun conditions

Dimension of A is  $\approx 2200 \times 2200 \times 2$  for a given retrieval (k) -32 mb

Can be reduced considerably by eigenvector decomposition

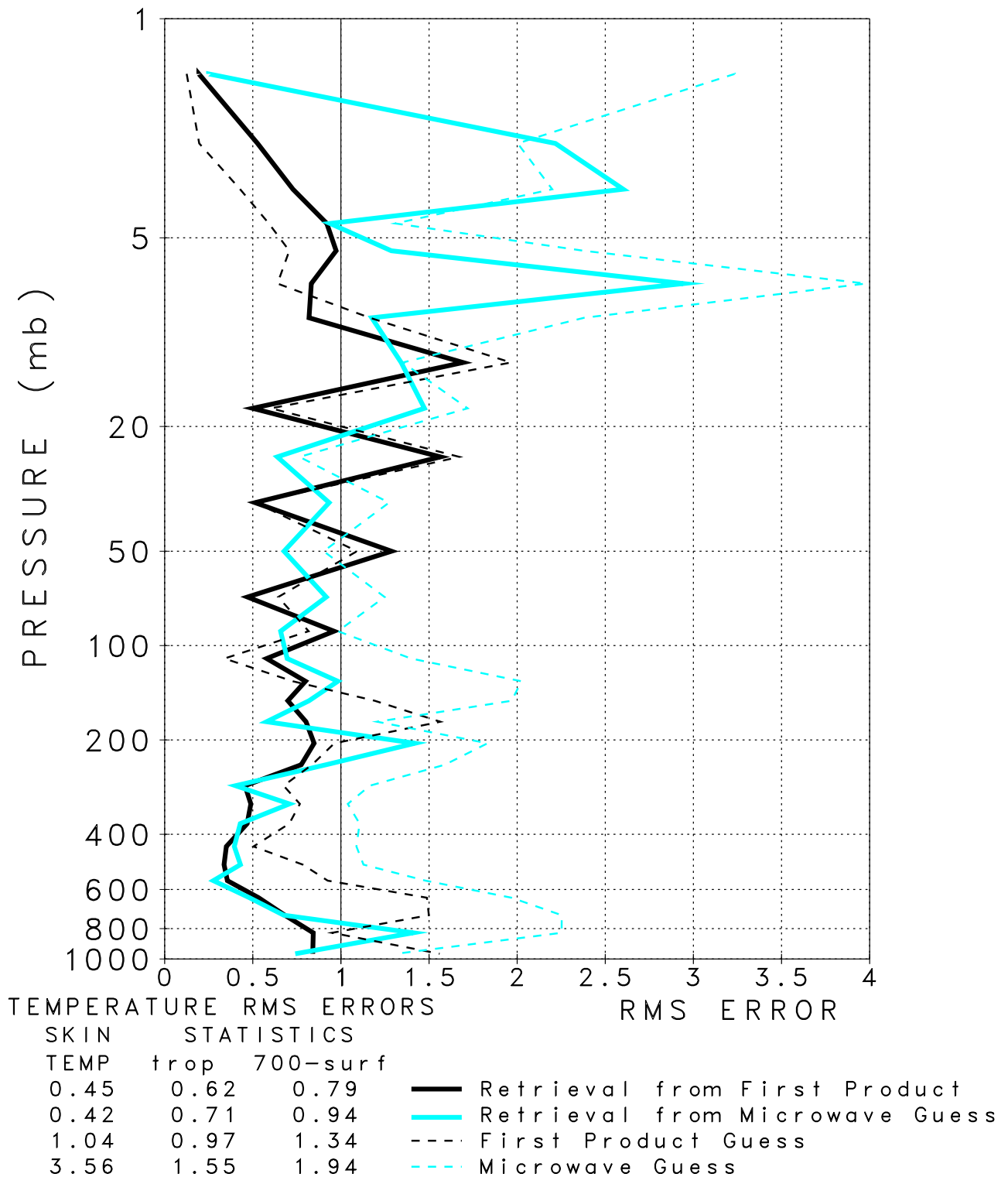
Requires considerable work - but highly desirable to analyze data at 90 angles

### Short Term Recommendation

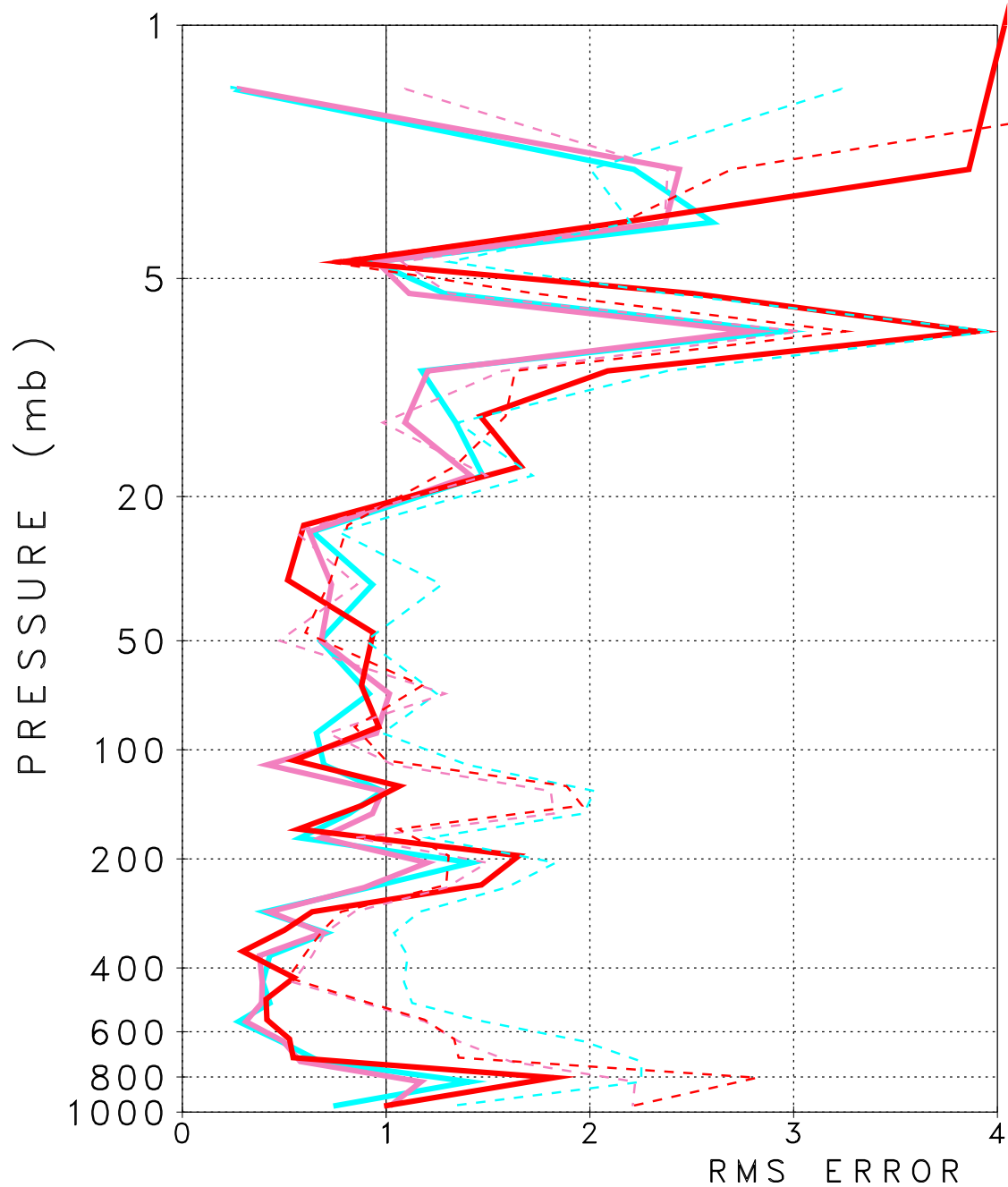
Generate first simulated orbit data using only central angle for each 3x3 block

Get a volunteer to generate A matrix

TRACK DC: OLD 66 LEVELS  
 LAYER MEAN RMS TEMPERATURE ERRORS (°C)



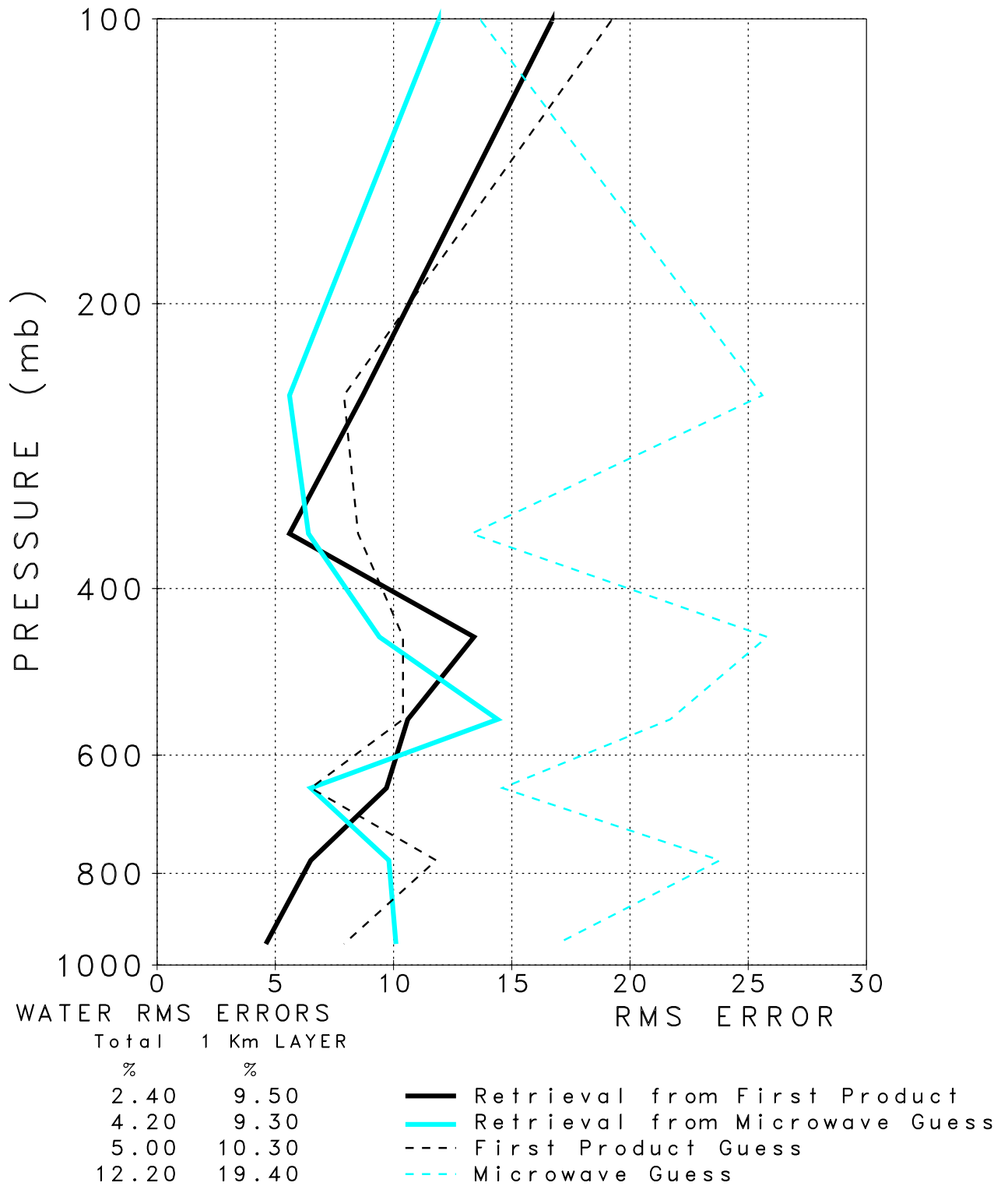
TRACK DC  
 LAYER MEAN RMS TEMPERATURE ERRORS (°C)



| SKIN | STATISTICS |          |
|------|------------|----------|
| TEMP | trop       | 700-surf |
| 0.42 | 0.71       | 0.94     |
| 0.40 | 0.69       | 0.92     |
| 0.34 | 0.82       | 1.12     |
| 3.56 | 1.55       | 1.94     |
| 1.68 | 1.28       | 2.01     |
| 1.68 | 1.33       | 2.13     |

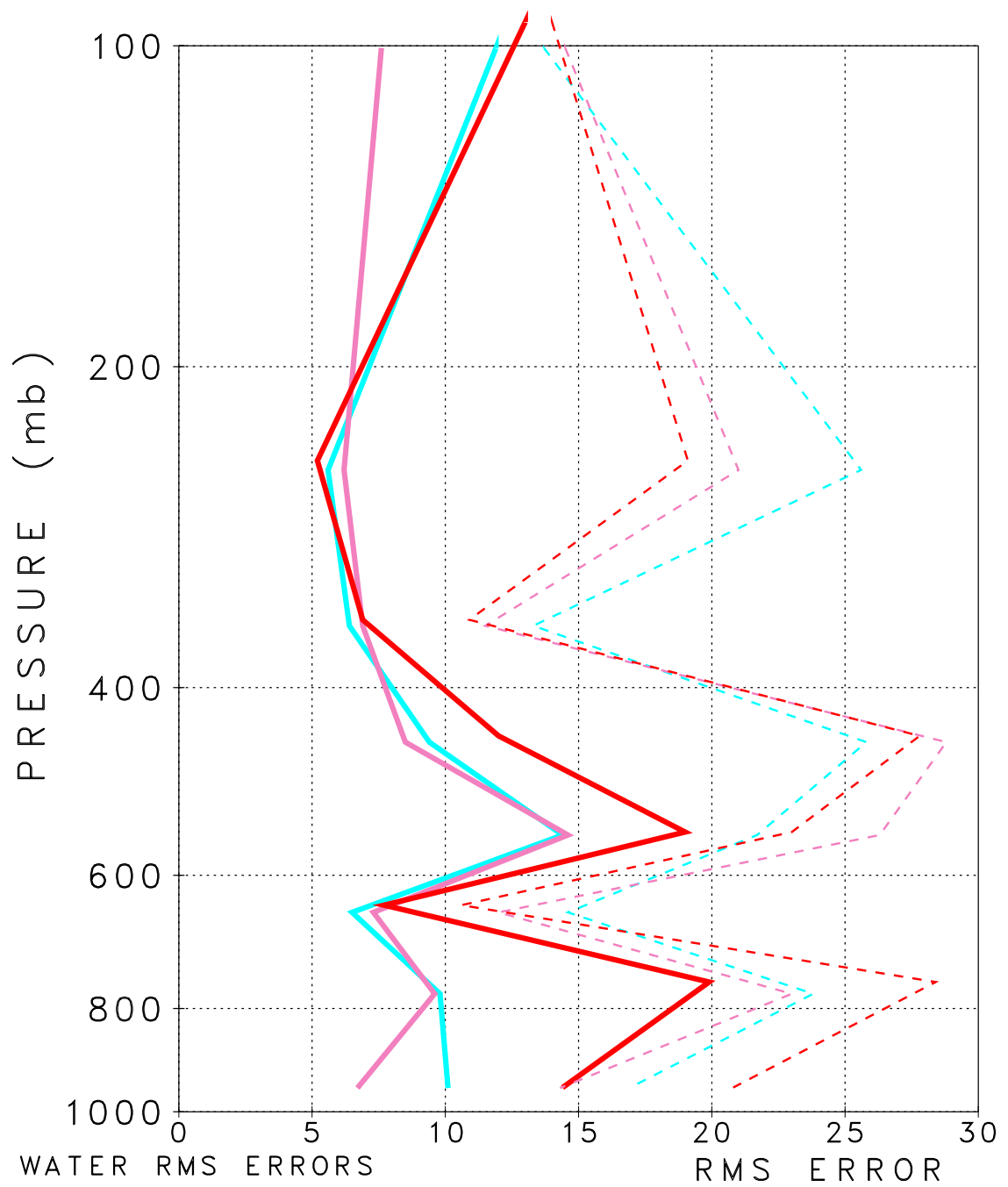
- Retrieval from Old 66
- Retrieval from New 66
- Retrieval from New 100
- Microwave Guess Old 66
- Microwave Guess New 66
- Microwave Guess New 100

TRACK DC: OLD 66 LEVELS  
 1 Km LAYER PRECIPITABLE WATER PERCENT ERRORS





TRACK DC  
1 Km LAYER PRECIPITABLE WATER PERCENT ERRORS



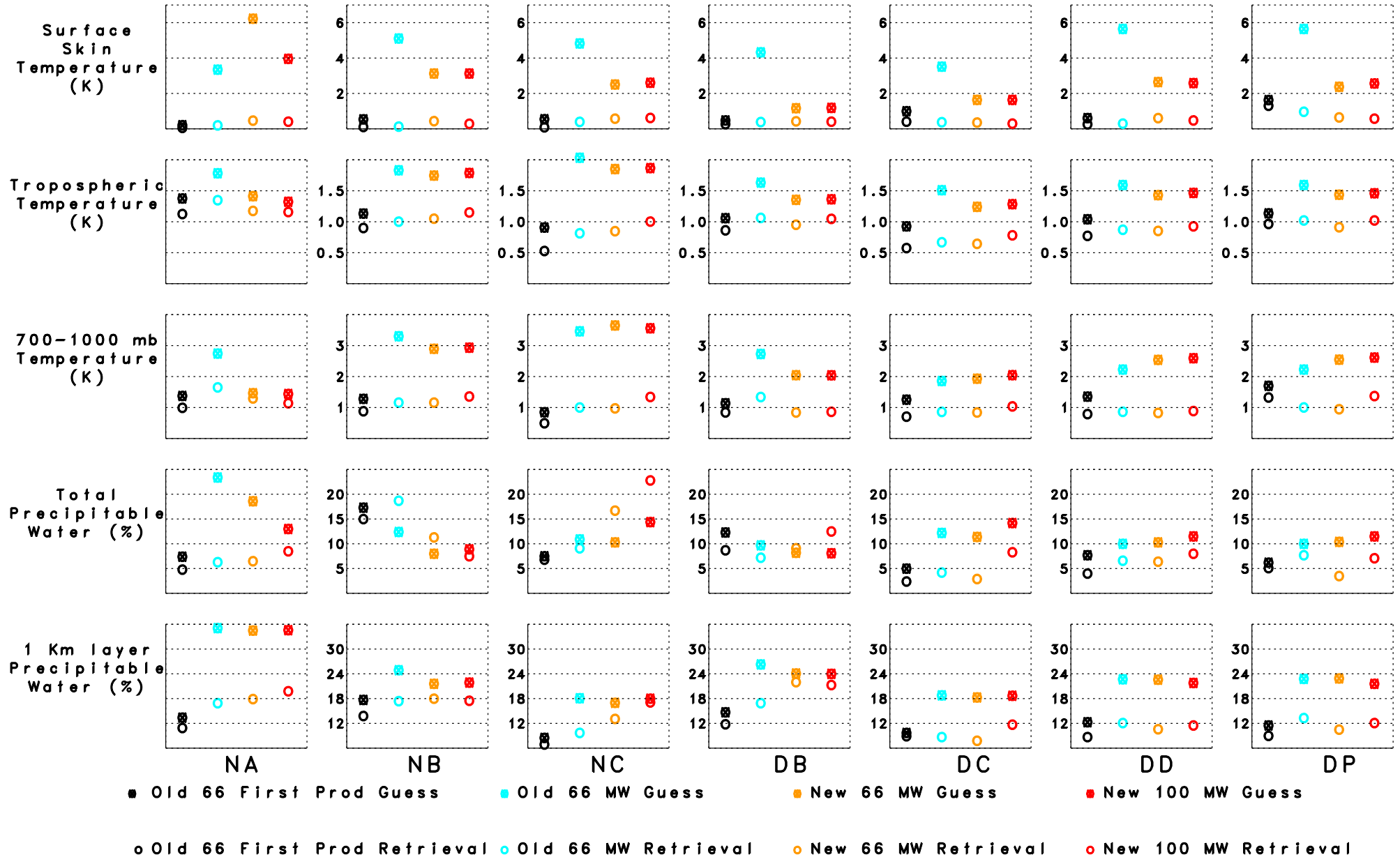
Total 1 Km LAYER  
%

|       |       |
|-------|-------|
| 4.20  | 9.30  |
| 2.90  | 8.40  |
| 8.30  | 12.30 |
| 12.20 | 19.40 |
| 11.40 | 18.90 |
| 14.20 | 19.30 |

|                         |
|-------------------------|
| Retrieval from Old 66   |
| Retrieval from New 66   |
| Retrieval from New 100  |
| Microwave Guess Old 66  |
| Microwave Guess New 66  |
| Microwave Guess New 100 |

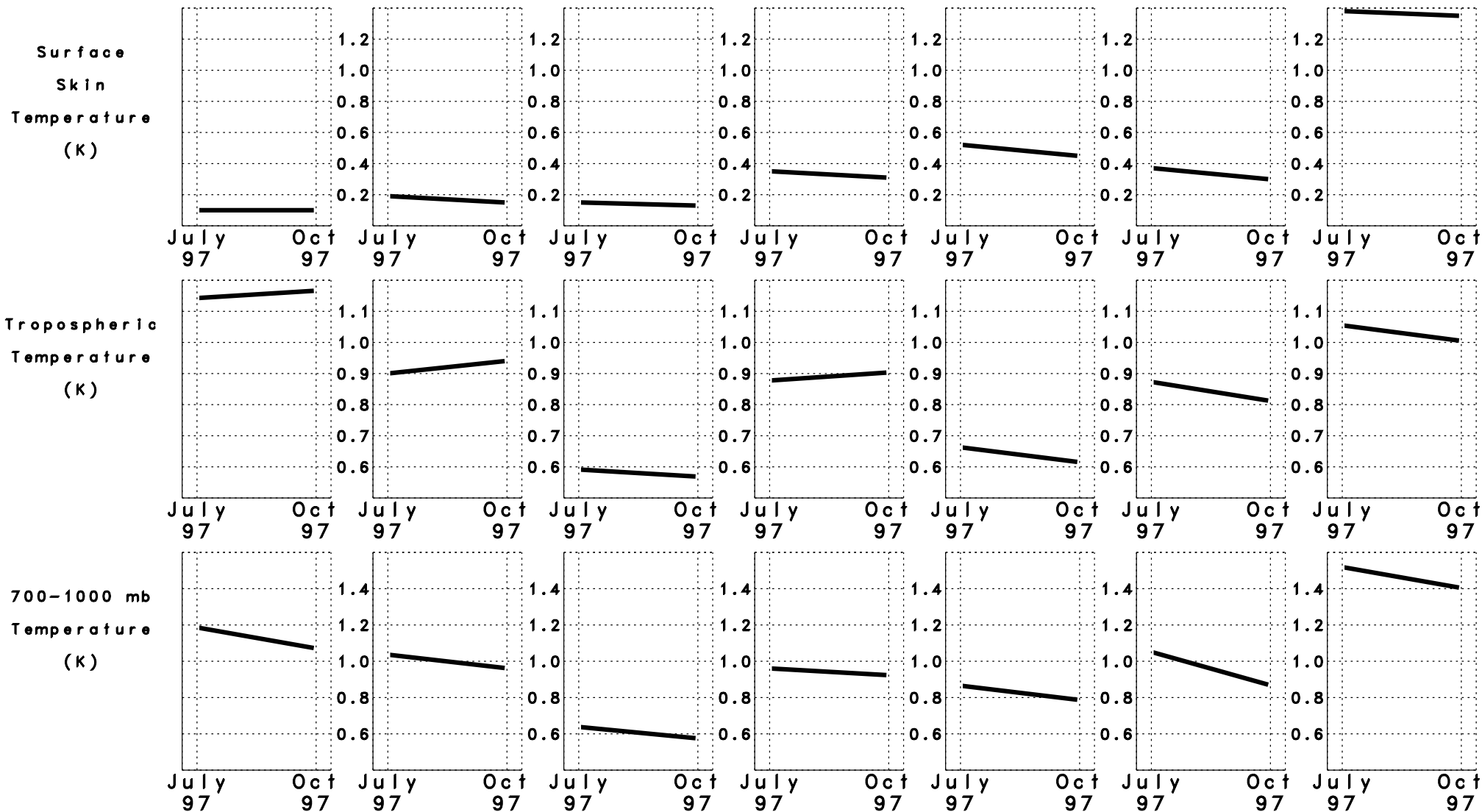
# JPL PROTOTYPE SYSTEM OCTOBER 1997

## RMS ERRORS



# JPL PROTOTYPE SYSTEM JULY 1997 FIRST PRODUCT GUESS

## RMS ERRORS



— Final Product Algorithm July 1997 to October 1997

# GSFC SYSTEM JULY 1997 FIRST PRODUCT GUESS RMS ERRORS

